Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-155

Anonymous Referee #3

Referee comment on "Infrasound measurement system for real-time in situ tornado measurements" by Brandon C. White et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-155-RC2, 2021

My comments will be mainly confined to meteorological/operational issues. I lack significant expertise in the sort of signal processing that forms the crux of the technique in this paper.

Near line 20. I think the bigger issue in the Southeast and elsewhere is the radar horizon. There aren't too many places where the base elevations are blocked.
Near line 20. I suggest breaking the multiple citations into those that pertain generally to infrasound studies, and those that suggest there is specific tornado structure/dynamics information.
Near line 21. Table 1 does not provide information on how tornadoes can be predicted or understood.
Near line 21. Instead of "decentralized" would "mobile" be more appropriate?
What does "provide widespread real-time infrasound coverage near tornado-bases without additional cost to the end user" mean? I'm puzzled.
Near line 40 "the details of the association technique are not included...". I'm glad you made this disclaimer; it makes this study of little value, at least as reported in the literature.
Near line 40. Did Dunn track tornadoes, or tornadic storms, or mesocyclones? Specifically, did the signal begin and end at the start/stop times of the tornadoes?
Love the acronym GLINDA :-)
Near line 76... check the "accuracy" of NWS tornado reports. They may report to 10 m signficant digits in lat/lon, but I'm guessing the start stop points are rarely known to better than 100 m or worse.
Near line 194... personal pet peeve... I really don't like the term "touch down" for tornadoes. Tornadoes just don't do this. Prior to formation of a tornado, there is a vortex extending to within meters of the ground, with the vortex lines extending horizontally outward from there. Depending on where the stretching is most intense, the vortex first becomes "tornadic" near the ground, or a variety of other heights. A "tornado formed" is much to be preferred. This might have implications for your work... a vortex can be quite strong at various heights prior to the condensation/debris that characterizes a tornado, so the begin/end of the visible manifestation, or even the damage, should not be expected to correspond exactly to your infrasound signals (unless, of course, those only occur when damage is being done or the vorticity reaches a threshold magnitude).
Near 195-196 the precision of lon, lat, length, and width are much beyond what the NWS

accomplishes in reality. I fault the NWS for using this precision in their reports.
195. Tornadogenesis is a process, not an event.
205. "weak rotation" is problematic for your study, is it not? I.e., it makes refuting the hypothesis of infrasound from the mesocyclone more problematic.
Figure 11 and Figure 12... this is about as deeply as I can delve into the signal analysis work. There are differences, clearly. But there simply cannot be conclusions drawn from two events that are "different", except that "differences can happen". And with that latter conclusion, of course, it is setting the stage for much more needed work across a statistically useful sample size. I'm not sure what this will be... additional cases will shed light. I have to believe that perhaps dozens of cases will be needed to see if the signal is really unique in tornadoes.
The amount of processing needed to extract these fairly small signals (is that a fair characterization?) makes me really worry that the analysis was tuned to extract the strongest possible result. This, of course, is pretty much the standard approach with rare phenomena... you want to know if there is any potential for discrimination. Again, just be clear that these uncertainties are part and parcel of limited data sets of rare phenomena.
There seems to be a general perception in the weather community that infrasound is going to provide information that is valuable for tornado anticipation. This may be the goal, and it may be what is communicated via the popular media, but this paper does not bolster that case. I'm not aware of formal literature that clearly does make that case. Please be clear about what is the eventual goal/hope of this research, and what is actually known. Two cases that exhibit somewhat different signals, obtained at close range, point the way to additional useful observations. They are simply not evidence of the utility of infrasound operationally. It must be shown that the signal is consistent, and that it occurs even when humans are not able to see the tornado visually or via radar signatures. And perhaps most important, I hope you will find a signal of the processes occurring in the 20 min prior to tornado formation. This is the time period when warnings are pretty bad. After tornado formation, it's pretty rare that the NWS is completely unaware of the presence of a tornado.